d- $u_C = \frac{q}{C} \Rightarrow \varphi_{u_C} = \varphi_q$ or $\varphi_i - \varphi_q = \frac{\pi}{2} \Rightarrow \varphi_i - \varphi_{u_C} = \frac{\pi}{2}$

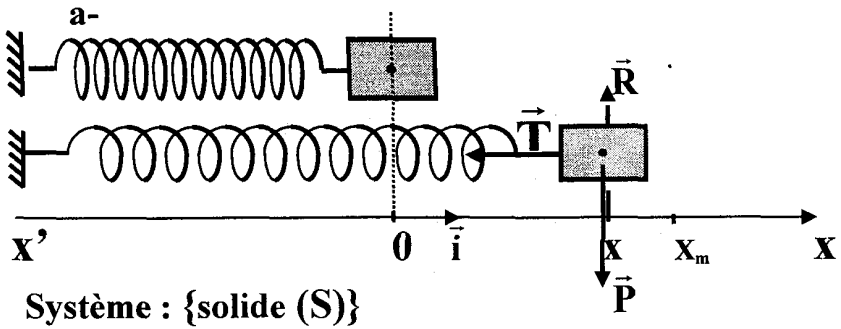
$\varphi_i = \varphi_u \Rightarrow \varphi_u - \varphi_{u_C} = \frac{\pi}{2}$

Exercice N°2 :

Parie (A) :

1°)

a-



Système : {solide (S)}

Bilan des forces : $\vec{P}, \vec{R}, \vec{T}$

RFD : $\vec{P} + \vec{R} + \vec{T} = m\vec{a}$

Projection sur (x,x') : $-kx = ma \Rightarrow m.\frac{d^2x}{dt^2} + kx = 0$

$\Rightarrow \frac{d^2x}{dt^2} + \frac{k}{m}x = 0$

b- $x = x_m.\sin(\sqrt{\frac{k}{m}}t + \varphi_x)$

$\frac{dx}{dt} = \sqrt{\frac{k}{m}}.x_m.\cos(\sqrt{\frac{k}{m}}t + \varphi_x)$

$\frac{d^2x}{dt^2} = -\frac{k}{m}.x_m.\sin(\sqrt{\frac{k}{m}}t + \varphi_x)$

Equation différentielle

$\Rightarrow -\frac{k}{m}.x_m.\sin(\sqrt{\frac{k}{m}}t + \varphi_x) + \frac{k}{m}.x_m.\cos(\sqrt{\frac{k}{m}}t + \varphi_x) = 0$

$\Rightarrow$ x(t) : solution de l'équation différentielle

c- $\Delta t = 12{,}56s \Rightarrow T = \frac{\Delta t}{n}$

$\omega = \sqrt{\frac{k}{m}} = \frac{2\pi}{T} \Rightarrow \frac{k}{m} = \frac{4\pi^2}{T^2} = \frac{4\pi^2}{(\Delta t)^2}.n^2$

$\Rightarrow m = \frac{\Delta t^2.k}{4\pi^2.n^2} = \frac{(12{,}56)^2.20}{4.(3{,}14)^2.400} = 0{,}2kg$

2°)

a- $E = \frac{1}{2}mV^2 + \frac{1}{2}kx^2$

b- $E = \frac{1}{2}mV^2 + \frac{1}{2}kx^2 = \frac{1}{2}.0{,}2.(0{,}2)^2 + \frac{1}{2}20.4.10^{-4} = 8.10^{-3}J$

$E = 8.10^{-3}J$

c- $\frac{dE}{dt} = \frac{1}{2}m.2V\frac{dV}{dt} + \frac{1}{2}k.2x\frac{dx}{dt} = \underbrace{(mV + Kx)}_{=0}.V \Rightarrow \frac{dE}{dt} = 0$

$\Rightarrow$ E se conserve

$E = \frac{1}{2}kx_m^2 \Rightarrow x_m^2 = \frac{2E}{k} \Rightarrow x_m = \sqrt{\frac{2E}{k}} = \sqrt{\frac{2.8.10^{-3}}{20}} = 2\sqrt{2}.10^{-2}m$

d- à t=0

$E = \frac{1}{2}kx_m^2 \Rightarrow x_m^2 = \frac{2E}{k} \Rightarrow x_m = \sqrt{\frac{2E}{k}} = \sqrt{\frac{2.8.10^{-3}}{20}} = 2\sqrt{2}.10^{-2}m$